98 Rec'd PCT/PTO 26 NOV 2001

FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
216270US

U S. APPLICATION NO. (IF KNOWN, SEE 37 CFR
09/926612

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/SE00/01069	**25 May 2000**	**27 May 1999**

TITLE OF INVENTION
A METHOD FOR A ROTATING ELECTRIC MACHINE AND A MACHINE FOR CARRYING OUT THE METHOD

APPLICANT(S) FOR DO/EO/US
Gengt ROTHMAN, et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

    Notice of Priority, Drawings (2 sheets)
    Request for Consideration of Documents Cited in the International Search Report

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/926612	INTERNATIONAL APPLICATION NO. PCT/SE00/01069	ATTORNEY'S DOCKET NUMBER 216270US

24. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS	PTO USE ONLY
☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	**$1040.00**		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	**$890.00**		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	**$740.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	**$710.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	**$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =		**$1,040.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).		**$130.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	56 - 20 =	36	x $18.00	**$648.00**	
Independent claims	3 - 3 =	0	x $84.00	**$0.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$1,818.00**	
☐ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				**$0.00**	
SUBTOTAL =				**$1,818.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$1,818.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	**$0.00**	
TOTAL FEES ENCLOSED =				**$1,818.00**	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of **$1,818.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ______ in the amount of ______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **15-0030** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Telephone #: (703) 413-3000
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Surinder Sachar
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SIGNATURE

Gregory J. Maier
NAME

25,599
REGISTRATION NUMBER

Nov. 26 2001
DATE

09/926612

JC13 Rec'd PCT/PTO 26 NOV 2001

Docket No. 216270US6X PCT

IN RE APPLICATION OF: Bengt ROTHMAN, et al.

SERIAL NO: New U.S. PCT Application based on PCT/SE00/01069

FILED: Herewith

FOR: A METHOD FOR A ROTATING ELECTRIC MACHINE AND A MACHINE FOR CARRYING OUT THE METHOD

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Transmitted herewith is an amendment in the above-identified application.

☒ No additional fee is required

☐ Small entity status of this application under 37 C.F.R. §1.9 and §1.27 is claimed.

☒ Additional documents filed herewith: Eglish Translation, Notice of Priority, Check for 1818.00, Drwings (2 sheets), PCT Transmittal Letter, Preliminary Amendment, International Search Report, Request for Consideration of Documents Cited in International Search Report

The Fee has been calculated as shown below:

CLAIMS	CLAIMS REMAINING		HIGHEST NUMBER PREVIOUSLY PAID	NO. EXTRA CLAIMS	RATE	CALCULATIONS
TOTAL	56	MINUS	56	0	× $18 =	$0.00
INDEPENDENT	3	MINUS	3	0	× $84 =	$0.00
		☐ MULTIPLE DEPENDENT CLAIMS			+ $280 =	$0.00
		TOTAL OF ABOVE CALCULATIONS				$0.00
		☐ Reduction by 50% for filing by Small Entity				$0.00
		☐ Recordation of Assignment			+ $40 =	$0.00
					TOTAL	$0.00

☐ A check in the amount of is attached.

☒ Please charge any additional Fees for the papers being filed herewith and for which no check is enclosed herewith, or credit any overpayment to deposit Account No. 15-0030. A duplicate copy of this sheet is enclosed.

☒ If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time may be charged to Deposit Account No. 15-0030. A duplicate copy of this sheet is enclosed.

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09/926612

JC13 Rec'd PCT/PTO 26 NOV 2001

Docket No. 216270US6X PCT

IN RE APPLICATION OF: Bengt ROTHMAN, et al.

SERIAL NO: New U.S. PCT Application based on PCT/SE00/01069

FILED: Herewith

FOR: A METHOD FOR A ROTATING ELECTRIC MACHINE AND A MACHINE FOR CARRYING OUT THE METHOD

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Transmitted herewith is an amendment in the above-identified application.

☒ No additional fee is required

☐ Small entity status of this application under 37 C.F.R. §1.9 and §1.27 is claimed.

☒ Additional documents filed herewith: Eglish Translation, Notice of Priority, Check for 1818.00, Drwings (2 sheets), PCT Transmittal Letter, Preliminary Amendment, International Search Report, Request for Consideration of Documents Cited in International Search Report

The Fee has been calculated as shown below:

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TOTAL	56	MINUS	56	0	× $18 =	$0.00
INDEPENDENT	3	MINUS	3	0	× $84 =	$0.00
		☐ MULTIPLE DEPENDENT CLAIMS			+ $280 =	$0.00
		TOTAL OF ABOVE CALCULATIONS				$0.00
		☐ Reduction by 50% for filing by Small Entity				$0.00
		☐ Recordation of Assignment			+ $40 =	$0.00
					TOTAL	$0.00

☐ A check in the amount of is attached.

☒ Please charge any additional Fees for the papers being filed herewith and for which no check is enclosed herewith, or credit any overpayment to deposit Account No. 15-0030. A duplicate copy of this sheet is enclosed.

☒ If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time may be charged to Deposit Account No. 15-0030. A duplicate copy of this sheet is enclosed.

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216270US-6X PCT
ENKEL 8628

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF:	:
BENGT ROTHMAN ET AL.	:
SERIAL NO: NEW APPLN. (Based on PCT/SE00/01069)	: ATTN: APPLICATION BRANCH

FILED: HEREWITH

FOR: A METHOD FOR A ROTATING ELECTRIC MACHINE AND A MACHINE FOR CARRYING OUT THE METHOD

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Prior to an action on its merits, please amend the above-identified application as follows:

IN THE CLAIMS

Please cancel Claims 1-48.

Please add new Claims 49-104.

49. (New) A method for operating a high voltage rotating electric machine, comprising steps of:

enclosing an electric field in a winding when the high voltage rotating electric machine is in operation;

cooling the stator to a temperature T1 when the high voltage rotating electric machine is in operation; and

heating the stator to a temperature T2 when the high voltage rotating electric machine is not in operation, wherein

said winding including an insulated electric conductor comprising at least one current carrying conductor, a first layer surrounding the at least one current carrying conductor, a solid insulation layer surrounding the first layer, and a second layer surrounding the solid insulation layer, and

said high voltage rotating electric machine including a stator, with a stator core having slots and the winding arranged in a plurality of slots in the stator core.

50. (New) A method according to Claim 49, wherein:

the temperature T2 is substantially equal to the temperature T1.

51. (New) A method according to Claim 49, wherein:

the temperature T2 is lower than the temperature T1.

52. (New) A method according to Claim 51, wherein:

the temperature T2 is lower than the temperature T1 by a differential range inclusive of 0-20 C.

53. (New) A method according to Claim 51, wherein:

the temperature T2 is lower than the temperature T1 by an inclusive differential range of 0-10 C.

54. (New) A method according to Claim 49, wherein:

the winding is installed in the plurality of slots of the stator during assembly of the machine with play so as to accommodate an expected thermal expansion of the winding during operation.

55. (New) A method according to Claim 49, wherein:

the winding, during assembly of the machine and before being installed in the slots of the stator core, is mechanically deformed and is configured to regain a non-deformed state when installed so as to bear on a wall of the plurality of slots.

56. (New) A method according to Claim 49, wherein:

the winding, during assembly of the machine and before installation in the slots of the stator, is cooled so as to undergo a thermal shrinkage, and is configured to regain an original shape upon heating so as to bear on a wall of the plurality of slots.

57. (New) A method according to Claim 49, further comprising a step of:

preheating the stator to a temperature T3 prior to an initial operation of the high voltage rotating electric machine.

58. (New) A method according to Claim 57, wherein:

the temperature T3 substantially corresponds to a predicted operating temperature T0 of the stator.

59. (New) A method according to Claim 57, further comprising a step of:

initiating operation of the machine once the stator has reached a temperature equal to the temperature T3.

60. (New) A method according to Claim 57, wherein:

the temperature T3 is lower than the predicted operating temperature T0 of the stator.

61. (New) A method according to Claim 57, wherein:

the temperature T3 is lower than the predicted operating temperature T0 by a differential range inclusive of 0-20 C.

62. (New) A method according to Claim 57, wherein:

the temperature T3 is lower than the predicted operating temperature T0 of the stator by a differential range inclusive of 0-10 C.

63. (New) A method according to Claim 49, wherein:

the stator core has a duct, with an expandable conducting means disposed in the duct configured to transport at least one of a heating operational medium and a cooling operational medium.

64. (New) A method according to Claim 63, further comprising a step of:

expanding the expandable conducting means so as to press the expandable conducting means against an inside wall of the duct and to obtain a heat transfer contact, wherein said expanding step is prior to an initial operation of the high voltage rotating electric machine.

65. (New) A method according to Claim 63, wherein:

the expandable conducting means is coated with a fusible adhesive agent before insertion into the plurality of ducts.

66. (New) A method according to Claim 65, wherein:

the fusible adhesive agent comprises a filler with a predetermined thermal conductivity.

67. (New) A method according to Claim 64, wherein:

said expanding step includes simultaneously subjecting the expandable conducting means to a pressure and a heat so as to cause the expandable conducting means to bear on the inside wall of the duct, to melt the fusible adhesive agent so as to essentially fill a plurality of cavities between the expandable conducting means and the inside wall of the duct, and to secure the expandable conducting means to the inside wall of the duct.

68. (New) A method according to Claim 63, wherein:

the expandable conducting means, before being inserted in the duct, is deformed radially to a diameter smaller than a diameter of the duct.

69. (New) A method according to Claim 49, wherein:

an expandable conducting means configured to transport at least one of a cooling operational medium and a heating operational medium is disposed into a plurality of cavities formed between a plurality of turns of the winding.

70. (New) A method according to Claim 69, further comprising a step of:

expanding the expandable conducting means so as to clamp the winding within the plurality of slots in the stator core.

71. (New) A method according to Claim 70, wherein:

said expanding step includes controlling the expansion so as to deform the expandable conducting means into a profile substantially corresponding to a geometric cross section of the plurality of cavities.

72. (New) A method according to Claim 71, wherein:

the profile is triangular.

73. (New) A method according to Claim 70, wherein:

said expanding step includes creating a vacuous condition.

74. (New) A method according to Claim 70, wherein:

said expanding step includes feeding a pressurized fluid into the expandable conducting means.

75. (New) A method according to Claim 70, wherein:

said expanding step includes substeps of

simultaneously subjecting the expandable conducting means to an overpressure and a heat, and

cooling the expandable conducting means while maintaining the overpressure.

76. (New) A method according to Claim 70, wherein:

said expanding step includes circulating a heat conducting pressurized fluid within the expandable conducting means.

77. (New) A method according to Claim 76, wherein:

the heat conducting pressurized fluid is the same as the at least one of the cooling operational medium and the heating operational medium.

78. (New) A method according to Claim 69, wherein:

the cooling operational medium and the heating operational medium are the same.

79. (New) A high voltage rotating electric machine, comprising:

a stator;

a stator core having slots;

a winding arranged in a plurality of slots in the stator core and having a plurality of winding turns laying adjacent to each other, said winding including an insulated electric conductor comprising at least one current carrying conductor, a first layer surrounding the at least one current carrying conductor, a solid insulation layer surrounding the first layer, and a second layer surrounding the insulation layer; and

a temperature control module, said temperature control module configured to cool the stator to a temperature T1 when the high voltage rotating electric machine is in operation and to heat the stator to a temperature T2 when the high voltage rotating electric machine is not in operation.

80. (New) A high voltage rotating electric machine according to Claim 79, wherein:

the temperature control device includes a supervision system and at least one of a heating device and a cooling device.

81. (New) A high voltage rotating electric machine according to Claim 79, wherein:

the temperature T2 is substantially equal to the temperature T1.

82. (New) A high voltage rotating electric machine according to Claim 79, wherein: the temperature T2 is lower than the temperature T1.

83. (New) A high voltage rotating electric machine according to Claim 82, wherein:

the temperature T2 is lower than the temperature T1 by a differential range inclusive of 0-20 C.

84. (New) A high voltage rotating electric machine according to Claim 82, wherein:

the temperature T2 is lower than the temperature T1 by a differential range inclusive of 0-10 C.

85. (New) A high voltage rotating electric machine according to Claim 80, wherein:

the supervision system is configured:

to measure a stator temperature before operating for a first time,

to control the at least one of a cooling device and a heating device so that the stator, before operating for the first time, is heated to a temperature T3, and

to prevent operation of the high voltage rotating electric machine before the stator temperature equals a temperature T3.

86. (New) A high voltage rotating electric machine according to Claim 85, wherein: the temperature T3 corresponds to a predicted stator operating temperature T0.

87. (New) A high voltage rotating electric machine according to Claim 85, wherein: the temperature T3 is lower than the predicted stator operating temperature T0.

88. (New) A high voltage rotating electric machine according to Claim 87, wherein: the temperature T3 is lower than the predicted stator operating temperature T0 by a differential range inclusive of 0-20 C.

89. (New) A high voltage rotating electric machine according to Claim 87, wherein:

the temperature T3 is lower than the predicted stator operating temperature T0 by a differential range inclusive of 0-10 C.

90. (New) A high voltage rotating electric machine according to Claim 87, wherein:

the winding is configured so as not to be secure in the stator slots before the stator temperature equals a temperature T3.

91. (New) A high voltage rotating electric machine according to Claim 79, further comprising:

an expandable conducting means configured to transport at least one of a cooling operational medium and a heating operational medium; and

a duct in the stator core.

92. (New) A high voltage rotating electric machine according to Claim 91, wherein:

the expandable conducting means is configured to expand under heat and pressure so as to press against an inside wall of the duct in the stator core.

93. (New) A high voltage rotating electric machine according to Claim 91, wherein:

the expandable conducting means is coated with a layer of a fusible adhesive agent.

94. (New) A high voltage rotating electric machine according to Claim 93, wherein:

the fusible adhesive agent contains a thermally conductive filler.

95. (New) A high voltage rotating electric machine according to Claim 91, wherein:

the expandable conducting means is simultaneously subjected to overpressure and heat so as to press the expandable conducting means against a wall of the duct, to melt the fusible adhesive agent, and to essentially fill a plurality of cavities between the expandable conducting means and the wall of the duct.

96. (New) A high voltage rotating electric machine according to Claim 91, wherein:

the expandable conducting means, before being inserted in the duct, is deformed radially to a diameter smaller than a diameter of the duct.

97. (New) A high voltage rotating electric machine according to Claim 79, further comprising:

an expandable conducting means for transporting at least one of a cooling operational medium and a heating operational medium.

98. (New) A high voltage rotating electric machine according to Claim 97, wherein:

the expandable conducting means is inserted into a plurality of cavities which are formed between the plurality of winding turns lying adjacent to each other, and is expanded so as to clamp the windings within the plurality of slots in the stator core.

99. (New) A high voltage rotating electric machine according to Claim 97, wherein:

the expandable conducting means has a profile that substantially corresponds to a geometric cross section of the plurality of cavities.

100. (New) A high voltage rotating electric machine according to Claim 99, wherein:

the profile is triangular.

101. (New) A high voltage rotating electric machine according to Claim 97, wherein:

the expandable conducting means is inserted in the plurality of slots of the stator core in a vacuum.

102. (New) A high voltage rotating electric machine according to Claim 98, wherein:

the expandable conducting means is expanded with a pressurized fluid.

103. (New) A high voltage rotating electric machine according to Claim 98, wherein:

the expandable conducting means is first simultaneously heated and subjected to an overpressure, and then cooled while retaining the overpressure.

104. (New) A high voltage rotating electric machine comprising:

a stator;

a winding disposed in slots in the stator including at least one current carrying conductor, a first semiconductor layer surrounding the current carrying conductor, a solid insulation layer surrounding the first semiconductor layer, and a second semiconductor layer surrounding the solid insulation layer;

means for cooling the stator to a temperature T1 when said machine is in operation; and

means for heating the stator to a temperature T2 when said machine is not in operation.

REMARKS

Favorable consideration of this Application as presently amended is respectfully requested.

Claims 49-104 are active in the present Application; Claims 1-48 having been canceled and Claims 49-104 added by way of the present Preliminary Amendment. The new claims have been drafted in a manner consistent with U.S. practice. It is therefore believed that no issues of new matter have been raised.

The present document is one of a set of patent applications containing related technology as was discussed in "response to petition under 37 C.F.R. §1.182 seeking special treatment relating to an electronic search tool, and decision on petition under 37 C.F.R. §1.183 seeking waiver of requirements under 37 C.F.R. §1.98," filed in the holding application (U.S. Patent Application No. 09/147,325). Consistent with this decision, a copy of the decision is filed herewith. Also, an Information Disclosure Statement is filed herewith including a PTO Form 1449 with references that are included as part of the specially-created

official digest in class 174. It is believed that submission of these materials and the reference to the holding application (Serial No. 09/147,325) is sufficient for the present Examiner to consider the references in the holding application, consistent with the decision.

Accordingly, examination on the merits of Claims 57-112 is believed to be in order, and an early and favorable action is respectfully requested.

Respectfully submitted,

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Marked-Up Copy
Serial No:
____
Amendment Filed on:
11-26-2001

IN THE CLAIMS

Claims 1-48 (Canceled).

Claims 49-104 (New).

09/926612
JC13 Rec'd PCT/PTO 26 NOV 2001

2/prts

A METHOD FOR A ROTATING ELECTRIC MACHINE AND A MACHINE FOR CARRYING OUT THE METHOD

The present invention relates to a method for a rotating electric machine for high voltage and such a rotating electric machine.

The present invention relates especially to a rotating electric machine having the type of winding as defined in the preamble of claims 1 and 26 respectively.

In this connection, rotating electric machines comprise synchronous machines, which are mainly used as generators for connection to distribution and transmission networks, referred to as power networks. Synchronous machines are also used as motors, in addition to phase compensation and voltage regulation and then as mechanically idling machines. This technical field also comprises normal asynchronous machines, dual-feed machines, alternating current machines, asynchronous converter cascades, outer pole machines and synchronous flux machines. These machines are intended for use at high voltages, i. e. voltages that mainly exceed 10 kV. A typical operating range for such a rotating machine may be 36 - 800 kV, and preferably 72,5 - 800 kV.

In conventional types of electric rotating machines the stator body is often designed in the form of a welded steel sheet construction. The stator core, also referred to as a steel core, is normally in larger machines formed of so-called electric sheet which is preferably 0,35-0,50 mm thick and divided into stacks. The stator core is provided with radial slots for the winding so as to form radial layers at different radial distances from the air gaps between the stator and the rotor. The term layer refers to layers of winding at different radial distances from the central axis of the stator. A winding turn is formed by that part of the winding, which extends once back and forth through the stator between different layers.

Rotating electric machines have conventionally been designed for voltages in the range of 6 - 30 kV, and 30 kV has normally been considered to be an upper limit. This generally means that a generator must be connected to the power network via a transformer, which steps up the voltage to the level of the power network, i.e. in the range of approximately 130 - 400 kV.

Different attempts have been made during the course of the years to develop especially synchronous machines, and more especially generators, for high

voltages. Such examples may be found among others in; "Electrical World", October 15, 1932, pages 524 - 525, the article; "Water-and-oil-cooled Turbo-generator TVM-300", in J. Elektrotechnika, No.1, 1970, pages 6 - 8, and in the patent publications US 4,429,244 and SU 955 369. However, none of these attempts have been successful or led to any commercially available product.

It has however been shown feasible to use high voltage insulated conductors as stator winding in a rotating electric machine, which have solid insulation and are of a design similar to cables used for transmission of electric power (e. g. so-called XLPE-cables). The voltage of the machine can be increased hereby to such levels that it can be connected directly to the power network without an intermediate transformer. Thus, among other things, the very important advantage of eliminating the conventional transformer is hereby achieved. A rotating electric machine with such a winding is described for instance in the PCT application WO 97/45919. Additional descriptions of the insulated conductor or cable can be found in the PCT applications WO 97/45918, WO 97/45930 and WO 97/45931.

The above-mentioned type of winding, principally corresponding to cables having solid, extruded insulation of a type presently used for power distribution, such as said XLPE-cables or cables having EPR-insulation, comprises an inner conductor composed of one or more strands, an inner semiconductive layer surrounding the conductor, a solid insulation layer surrounding the inner semiconductive layer and an outer semiconductive layer surrounding the insulation layer. Such cables are flexible, which is an essential property in this context since the technology for the device, according to the invention, is based primarily on a winding system in which the winding is formed from conductors, which are bent during assembly. The flexibility of an XLPE-cable normally corresponds to a radius of curvature of approximately 20 cm for a cable 30 mm in diameter, and a radius of curvature of approximately 65 cm for a cable 80 mm in diameter. In the present application the term flexible is used to indicate that the winding is flexible down to a radius of curvature in the order of 4 times the cable diameter, preferably 8 to 12 times the cable diameter.

The winding should be designed so as to retain its properties even when it is bent and subjected to thermal stress during service. In this connection, it is vital that the layers retain their adhesion to each other. The material properties of the layers are decisive here, particularly their resiliency and relative coefficients of

thermal expansion. In an XLPE-cable, for example, the insulation layer consists of cross- linked, low-density polyethylene and the semiconductive layers consist of polyethylene compounded with soot and metal particles. Changes in volume, as a result of temperature fluctuations, are fully accommodated in the form of changes in the radius of the cable and thanks to the comparatively slight difference between the coefficients of thermal expansion of the layers in relation to the resiliency of these materials the radial expansion of the cable can take place without adhesive failures between the layers.

The material combinations stated above are considered by way of example only. Other combinations fulfilling the above-mentioned conditions and the condition of being semiconductive, i. e. having a volume resistivity within the range of 10^{-1} - 10^{6} ohm-cm, such as 1 - 500 ohm-cm, or 10 - 200 ohm-cm for example, naturally fall within the scope of the invention.

The insulating layer can consist, for example, of a solid thermoplastic material such as low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), polybutylene (PB), polymethyl pentene (PMP), cross-linked materials such as cross-linked polyethylene (XLPE), or rubber such as ethylene propylene rubber (EPR) or silicone rubber.

The inner and outer semiconductive layers may be made of the same basic material but compounded with particles of conducting material such as soot or metal powder.

Ethylene-vinyl-acetate copolymers/nitrile rubber, butyl graft polyethylene, ethylene-butyl-acrylate-copolymers and ethylene-ethyl-acrylate copolymers may also constitute suitable polymers for the semiconductive layers.

Even when different types of material are used as a base in the respective layers, it is desirable that their coefficients of thermal expansion are of the same magnitude. This is the case in the above listed combination of materials.

The materials listed above have a relatively good resiliency, with an E-modulus of E < 500 MPa, preferably < 200 MPa. The resiliency is sufficient for any possible minor differences between the coefficients of thermal expansion of the materials in the layers to be accommodated in the radial direction so that no cracks or other damage appear and so that the layers do not loose adhesion to each other. The materials in the layers are elastic, and the adhesion between the layers is at least of the same magnitude as the weakest of the materials.

The conductivity of the two semiconductive layers is sufficient to substantially equalise the potential along each respective layer. The conductivity of the outer semiconductive layer is sufficiently high to enclose the electrical field within the cable, but sufficiently small so as to not give rise to significant losses due to currents induced in the longitudinal direction of the layer.

Thus, each of the two semiconductive layers essentially constitutes one equipotential surface, and the winding constituting these layers substantially confines the electrical field within itself.

However, nothing prevents one or more additional semiconductive layers from being arranged in the insulating layer.

One problem arising with the use of an XLPE-insulated conductor and the like when used as winding is their expansion, because of their relatively high coefficient of thermal expansion, which occurs as a result of heating when operating the machine. The normal operating temperature for a machine of the present type is in the order of 70°C, which is considerably lower than that of conventional machines that have an operating temperature of approx.100-120°C. The difference in temperature between the machine in operation or out of operation, which temperature difference is normally in the order of 50°C but may even be considerably higher if the machine is placed outdoors in a cold climate, causes an XLPE-insulated conductor that is securely fastened within the stator slots when the machine is in operation, to shrink when the operation of the machine is interrupted and the XLPE-insulated conductor can very possibly loose adhesion to the walls of the slot so that it is more or less loosely positioned when the machine is out of operation. This loose conductor creates a problem when the machine starts operating again. The XLPE-insulated conductor and the stator slots are alternatively dimensioned in such a way in relation to each other that the conductor is fastened within the slot even when the machine is out of operation. When the machine consequently starts operating and the temperature starts rising, the XLPE-insulated conductor in the slots expands thermally and risks being damaged in the slots. Special devices for securing and maintaining the XLPE-insulated conductor may be used as another alternative, but which have the disadvantage of being both costly and difficult to install.

The present invention intends to solve the above-mentioned problems, which are caused by differences in temperature and the thermal expansion of the winding.

The problem is solved, according to the present invention as defined in the characterizing part of claim1, by a method where the stator is cooled while during operation to a temperature T1, and where it is heated while out of operation to a temperature T2. A corresponding rotating electric machine solves the problem as defined in the characterizing part of claim 26. The rotating machine thus comprises a device for cooling the stator, while during operation, to a temperature T1, and for heating the stator, while out of operation, to a temperature T2. The advantage achieved hereby is that said temperature differences are reduced, thereby reducing the thermal expansion of the winding. Because the temperature differences are reduced to a high degree in this way or, according to an especially preferred embodiment, are equalised completely, see below, the problems of different thermal expansion between the solid insulation and the layers surrounding the insulation of the insulated electric conductor in use is also eliminated. Reducing the temperature variation in this way, or alternatively equalising the temperature, makes a freer choice of material in the insulated conductor possible. Thus, other conducting materials, having larger temperature coefficients, may be used and materials having different temperature coefficients may be combined in the solid insulation and surrounding layers.

According to an especially advantageous feature, this device comprises at least one cooling and heating system for the stator and one supervision system comprising means which measure the temperature of the stator both during operation and out of operation respectively, and means which control the cooling and heating system such that said temperatures T1, which the stator cools down to when it is in operation, and T2, which the stator heats up to when it is out of operation respectively, are obtained and maintained.

According to an advantageous feature, the temperature T2 is preferably essentially equal to the temperature T1, which means that the temperature of the stator is held essentially constant regardless of whether it is in operation or not.

According to another advantageous feature, the temperature T 2, which the stator is heated up to when it is out of operation, is somewhat lower than the temperature T1, which the stator is cooled down to when it is in operation, where-

by T2 is preferably in the range of 0 - 20^0 C lower than T1, and with advantage in the range of 0 - 10^0 C lower than T1, or in the order of 10 - 15% lower than T1.

The insulation of the XLPE-conductor remains at a constant volume because the temperature is constant or close to constant, which simplifies securing and assembly of the winding in addition to simplifying and making the whole principle of construction trustworthy. No noticeable relative movements are obtained as a result of differences in the coefficients of expansion between the different parts of the stator and the winding.

According to an advantageous embodiment, the winding is installed, during assembly of the machine, in the slots of the stator with play, which essentially corresponds to the expected expansion of the winding during the operating temperature of the machine. The winding, before installation in the slots of the stator, can alternatively be deformed mechanically in such a way that the winding, which is installed thereafter in the slots, returns to its non-deformed state and bears on the walls of the slot. According to another alternative, the winding may be cooled down before installation in the slots of the stator, undergoing thereby thermal shrinkage, after which the winding is installed in the slots and regains its original state as a result of heating whereby the winding bears on the walls of the slot. In all cases the stator is heated, after the winding has been installed but before operating, with advantage to a temperature T3, which preferably essentially corresponds to the expected operating temperature T0.

Thus, the system for supervision of the machine comprises with advantage also means for measuring the temperature of the stator before being taken into operation for the first time, means controlling the cooling and heating system such that the stator, before operating for the first time, is heated to a temperature T3, and means which control the machine such that it is taken into operation only when the temperature T3 has been reached.

The temperature T3 may even be somewhat lower than the expected operating temperature of the stator T0, whereby T3 is preferably in the range of 0 - 20^0C lower than T0, and with advantage in the range of 0 - 10^0C lower than T0.

The advantage of having a winding which is not fastened within the slot of the stator until the operating temperature has essentially been reached is obtained by utilising, among other things, the "memory effect" of an XLPE-insulated conduc-

tor or similar conductor which is released by heat or time. This also improves the possibilities of replacing a damaged part of the winding.

According to an preferred embodiment, the cooling and heating system of the rotating machine comprises at least one expandable conducting means for transportation of a cooling and/or a heating medium, which is inserted into ducts in the stator core, which are adapted for this purpose, in addition to means for the expansion of said conducting means, whereby said conducting means after having expanded, presses against the inside of the duct in order to obtain good contact and heat transfer.

Said conducting means, which is preferably a proportionately rigid tube made of XLPE material or the like, has with advantage, before being inserted, been coated with a layer of fusible adhesive, in the form of glue film for example, which is wound onto the tube or extruded on the outside of the tube. The thickness of the layer may be in the range of one to some tenths of a mm. The fusible adhesive may contain a filler having good thermal conductivity such as aluminium oxide or boron nitride.

Additionally, the machine comprises with advantage means for the expansion of the conducting means, comprising means for simultaneously subjecting the conducting means to overpressure and heating, so that the conducting means bears on the walls of the duct and so that said fusible adhesive melts and substantially fills all cavities between the conducting means and the walls of the duct, whereby the conducting means is secured against the walls of the duct. Pressurisation and heating can take place by, for example, warm glycol being circulated inside the conducting means. Heating up to approx. 150^0 is required for the XLPE material and the conducting means to expand, and the medium used for pressurisation and heating must therefore be able to withstand this temperature. Besides, the medium can consist of the cooling and /or heating medium, which is used later for cooling and heating the stator respectively. The conducting means becomes supple and can be reshaped during heating and the glue, which melts and fills up possible cavities between the conducting means and the stator core, then hardens and secures the conducting means when cooling down. This arrangement has the advantage of being able to substitute the injection of silicon rubber, which is otherwise used for securing the conducting means and as a "sealing" between the conducting means and the stator ducts. The invention therefore shortens the distance

that the heat travels between the stator core and the conducting means by approx. 2 mm.

According to a variant, the conducting means can be deformed radially, before being inserted into the duct, so as to correspond to a smaller diameter than that of the duct.

According to another preferred embodiment, the cooling and heating system of the rotating machine comprises at least one expandable conducting means for transportation of a cooling and/or a heating medium, which conducting means is inserted into the slots of the stator core, in the cavities that are formed between the turns of the winding lying adjacent to each other, in addition to means for the expansion of said conducting means, whereby said conducting means, after having expanded, clamps the winding firmly within the stator slots. This conducting means has with advantage a profile, which principally corresponds to the geometrical cross-section of said cavities and which is preferably an essentially triangular profile.

According to a variant, the expandable conducting means is inserted into the slots of the stator core in an evacuated condition. The conducting means may, for example, be made of reinforced hose and said means for the expansion of the conducting means, being inserted into the slots of the stator core, preferably comprise means for feeding a pressurised fluid into the conducting means. The conducting means can, for example, be pressurised by means of a static water pressure, whereby the winding is clamped firmly within the stator slot. The water can be circulated thereafter in order to heat and cool the slot/stator and winding respectively.

According to another variant, said means for the expansion of the conducting means comprise means for simultaneously subjecting the conducting means to overpressure and heating, and the machine also comprises means for cooling the conducting means while retaining an overpressure, whereby the conducting means retains its expanded form. The conducting means then preferably constitutes an XLPE-tube or is made of a similar material, which can be made to expand in a corresponding manner to the above-mentioned description of the conducting means within the ducts of the stator core, and which has the corresponding advantages.

Additional features and advantages of the present invention will be made evident in the remaining dependent claims.

Thus, not only has a solution been found for the problem of avoiding temperature changes in the stator and other problems in this connection, improved ways and devices have also been found for securing the winding in the stator slots and fastening the conducting means for heating and cooling purposes within the ducts in the stator core and the slots, in addition to finding a solution for improved heat transmission.

Embodiments of the present invention will now be described, by way of example only, with particular reference to the accompanying drawings in which:

Figure 1	shows a schematic sketch of the supervision system, which is part of the invention;
Figure 2	shows a schematic sketch illustrating the installation of the winding in the stator slots;
Figure 3	shows a variant of the installation of the winding;
Figure 4	shows ducts in the stator core, into which a conducting means for transportation of a cooling and/or heating medium has been inserted;
Figure 5	shows stator slots with winding and conducting means for transportation of the cooling and/or heating medium; and
Figure 6	shows an example of an insulated electric conductor suitable for use as winding.

Figure 1 shows schematically, in accordance with the invention, the specifications that a supervision system for a rotating electric machine will perform. As mentioned above, it is desirable that the temperature of the stator, when it has been put into operation, remains relatively constant. In order to achieve this, a system cooling the stator in operation and heating the stator when it is out of operation is required as well as a supervision system. Examples of different embodiments constituting cooling and heating systems will be shown below, not excluding other possible embodiments. Measurement of the temperature of the stator is an important part of the supervision system. The supervision system can naturally also be used to control the temperature that the conducting means for cooling and heating the stator and winding respectively are heated up to and cooled down to respectively during installation, as well as controlling the pressure they are subjected to, or anything else that is serviceable in this connection. The supervision

system and controlling system inclusively, for the cooling and heating system and the measurement of the temperature of the stator are preferably computerised. Such a system can be designed with the help of known technique and will therefore not be described in detail herewith.

As in the above-mentioned, it is especially desirable to use a type of insulated electric conductor or cable, which is a so-called XLPE-cable, as winding which in the present connection is also termed an XLPE-insulated conductor. This cable expands when the temperature rises, i. e. when the machine is in operation and this condition can be exploited during installation of the cable. As illustrated in Figure 2, on the right hand side of the illustration, the cable 8 is installed in the stator slots with play between the outside of the cable and the inside of the slot. When the stator is heating up, which must take place before it is put into operation because the winding, shown on the right hand side of Figure 2, has not been fastened in the slots yet, the cable expands thermally so that it bears on the slot and is thus secured in the slot. The machine is then ready for service. The purpose of the supervision system is to control the temperature of the stator so that it reaches a temperature that approximately corresponds to the operating temperature, of which temperature the cable is presumed to be secured in the slot, before the machine starts operating. A stator slot 9' is illustrated on the left-hand side of Figure 2 where the winding/cable 8' has expanded to such an extent that it is secured adjacent to the inner wall of the slot and the machine is then ready for service.

Alternatively, the "memory effect" of the cable can be utilised in order to cool down the cable before installation in the slot. When the cable is heated the cable regains its original dimension and then bears on the walls of the slot and the iron core.

It should be noted that it is important that, when the operating temperature has been reached, it be kept at a fairly constant level, i. e. when the machine is out of operation, a temperature is maintained, which is approximately equal to the operating temperature derived from heating, so that the winding will not loosen its adjacent hold on the inside of the stator slots as a result of shrinkage when cooling down too much.

The variant illustrated in figure 3, for installation of the winding, shows a stator having especially designed slots 19 for the winding, i.e. slots, which are oval in the radial direction. Two electric conductors 18 are installed in each such oval

slot 19, i.e. corresponding to two winding turns. Thus, the conductors of the winding can be wound two at a time. This variant is especially advantageous for air-cooling but can naturally also be used in other types of cooling. More space is usually needed in the slots in order to utilise air-cooling and by winding the conductors of the winding two at a time, in the oval slots, a duct shaped space is formed between the two conductors in a slot, which duct may be utilised for cooling. Thus, this invention makes it possible to cool both the winding and the stator teeth by means of air.

The conductors 18 may suitably be treated and installed in accordance with the method described above, in connection with figure 2. Alternatively or complementary thereto, combined means 17, which are of a corresponding type and can be arranged in a corresponding way to the above, may be applied between the two conductors 18 in a slot 19 in order to clamp the conductors and which means can be utilised for cooling/heating the stator and the winding, which will be described further below.

It should be noted that the invention illustrated in figure 3 can also constitute a separate invention as regards a stator having oval slots in which the conductors of the winding are installed two at a time, which invention is not solely confined to a rotating electric machine of the type referred to in claim 26 or to the method defined in claim 1. It should also be noted that the means 17 could be constituted of winding clamping means of any suitable type, i. e. without the combined cooling and/or heating function.

Figure 4 shows how the cooling/heating of the stator may be carried out. The stator core 20 is provided with a plurality of ducts 21 for cooling/heating. A conducting means 22 is inserted into these ducts in order to transport a cooling and/or heating medium, which conducting means preferably constitutes an XLPE-tube or the like. The tube has preferably been deformed radially in advance so that it corresponds to a diameter that is smaller than the diameter of the duct in the stator steel sheets. In any case, the tube 22 has a diameter of d_1, which is smaller than the diameter of the duct d_k. This considerably simplifies the process of leading the tube into the duct. The tube 22 is then allowed to expand in the duct until it attains a diameter d_2 which preferably corresponds to or is somewhat bigger than the smallest diameter d_k of the duct in order to ensure that the conducting means/-tube is secured and bears on the inside of the duct, and thereby to the stator steel

sheets, in such a way that it obtains good contact and good heat transfer. The expansion of the tube is preferably achieved through a combination of heating and pressure, caused by a heated, compressed fluid circulating through the conducting means.

The conducting means/tube can be coated on its outside with a layer of fusible glue film, which melts when the tube is heated in order to further improve the process of fastening the conducting means so that it bears on the inside of the duct. The glue then fills all possible cavities between the conducting means and the stator sheet layers in the core duct. The glue film can also contain a filler having good thermal conductivity such as aluminium oxide or boron nitride, which further improves the melting of the glue and the contact of the conducting means to the stator sheets as well as the heat transfer between the conducting means and the stator.

Figure 5 shows how a conducting means 27 for transportation of a cooling and/or heating medium can be located in the space between the winding 28 and the stator slot 29. This conducting means can have the same characteristics as the conducting means, being used in the ducts in the stator core. Thus, this conducting means can be constituted of an XLPE-tube which has advantageously been given a triangular profile, which corresponds to the form of the accessible space between the inside of the stator slot and two winding turns 28 lying adjacent to each other. This could have taken place through deforming the conducting means. The conducting means can expand in a corresponding way to the abovementioned after having been inserted, i. e preferably by means of a combination of heating and pressurising a medium circulating through the conducting means. Thus, the conducting means hereby bears on both the insides of the slot and the winding whereby the conducting means thus fixes the winding within the stator slot. Good contact is established at the same time between the conducting means and the winding as well as the stator sheets, which is favourable for heat transfer and can thus be utilised for cooling and heating of the stator (and the winding) respectively. The conducting means in this figure 5 is only arranged on the one side of the winding but can naturally be arranged on both sides of the winding, such as shown previously in figure 3. It is also noteworthy that figure 3 illustrates a corresponding conducting means in a non-expanded condition.

A reinforced hose can alternatively also be used as a conducting means instead of the XLPE-tube, which is preferably threaded in an evacuated condition into the accessible spaces. This is thereafter pressurised by means of static water pressure and clamps the winding cable in this manner within the slot.

Finally, a cross-section of an insulated electric conductor/cable is shown in figure 6, which is especially suitable for use as winding in the stator according to the invention. The cable 30 comprises at least one current carrying conductor 31 surrounded by a first semiconductive layer 32. An insulation layer 33 is arranged around this first semiconductive layer, which layer is surrounded in turn by a second semiconductive layer 34. The electric conductor 31 can consist of a plurality of strands 35. The three layers are designed in such a way that they adhere to each other even when the cable is bent. The flexibility of the shown cable is a life-long characteristic. The illustrated cable also differs from conventional high voltage cables because the outer, mechanical protective sheathing and the metal screen, which normally surrounds such a cable, are eliminated.

The present invention should not be considered limited to the shown embodiments, but can be varied by a person skilled in the art in numerous ways within the frame of the invention as defined in the attached patent claims.

CLAIMS

1. A method for a rotating electric machine for high voltage, comprising a rotor and a stator having a core and a winding arranged in slots in the stator core, which winding encloses the electric field and is provided by means of an insulated electric conductor (30) comprising at least one current carrying conductor (31) and also comprising a first layer (32) surrounding the current carrying conductor, a solid insulation layer (33) surrounding said first layer, and a second layer (34) surrounding the insulation layer, **characterized** by the stator being cooled down, when it is in operation, to a temperature T1, and the stator being heated up, when it is out of operation, to a temperature T2

2. A method according to claim 1, **characterized** in that the temperature T2, which the stator is heated up to when it is out of operation, is essentially equal to the temperature T1, which the stator is cooled down to when it is in operation.

3. A method according to claim 1, **characterized** in that the temperature T 2, which the stator is heated up to when it is out of operation, is somewhat lower than the temperature T1, which the stator is cooled down to when it is in operation, whereby T2 is preferably in the range of 0 - 20° C lower than T1.

4. A method according to claim 1, **characterized** in that the temperature T 2, which the stator is heated up to when it is out of operation, is somewhat lower than the temperature T1, which the stator is cooled down to when it is in operation, whereby T2 is preferably in the range of 0 - 10° C lower than T1.

5. A method according to any one of the preceding claims, **characterized** in that the winding (8), during assembly of the machine, is installed in the slots (9) of the stator with play which essentially corresponds to the expected expansion of the winding during the operating temperature of the stator.

6. A method according to any one of claims 1 - 4, **characterized** in that the winding, during assembly of the machine and before being installed in the slots of the stator, is deformed mechanically in such a way that the winding will regain its

non-deformed state when it is installed thereafter in the slots so that it bears on the walls of the slots.

7. A method according to any one of claims 1 - 4 or 6, **characterized** in that the winding, during assembly of the machine and before installation in the slots of the stator, is cooled down so that it undergoes thermal shrinkage, after which it is installed in the slots and thereupon regains its original shape as a result of heating so that the winding bears on the walls of the slots.

8. A method according to any one of claims 5 - 7, **characterized** in that the stator, after installation of the winding in the slots but prior to its operation, is heated up to a temperature T3.

9. A method according to claim 8, **characterized** in that the temperature T3 essentially corresponds to the expected operating temperature T0 of the stator, and that the machine only begins operating once this temperature T3 has been reached.

10. A method according to claim 8, **characterized** in that the temperature T3 is somewhat lower than the expected operating temperature T0 of the stator, whereby T3 is preferably in the range of 0 - 20° C lower than T0.

11. A method according to claim 8, **characterized** in that the temperature T3 is somewhat lower than the expected operating temperature T0 of the stator, whereby T3 is preferably in the range of 0 - 10° C lower than T0.

12. A method according to any one of the preceding claims, **characterized** in that an expandable conducting means (22) for transportation of a cooling and/or a heating medium is inserted in ducts (21) provided therefore in the stator core (20), after which said conducting means is allowed to expand so that the conducting means is pressed against the inside of the duct in order to obtain good contact and heat transfer.

13. A method according to claim 12, **characterized** in that the conducting means before insertion is coated with a layer of fusible adhesive agent.

14. A method according to claim 13, **characterized** in that the fusible adhesive agent contains a filler having good thermal conductivity.

15. A method according to any one of claims 13 - 14, **characterized** in that the conducting means expands because it is simultaneously subjected to pressure and heating, thereby bearing on the walls of the duct and that said fusible adhesive agent then melts and essentially fills all cavities between the conducting means and the walls of the duct, whereby the conducting means is secured to the walls of the duct.

16. A method according to any one of claims 12 - 15, **characterized** in that the conducting means, before being inserted in the duct, is deformed radially so as to correspond to a diameter smaller than the diameter of the duct.

17. A method according to any one of the preceding claims, **characterized** in that an expandable conducting means (17; 27) for transportation of a cooling and/or a heating medium is inserted in the slots (19; 29) of the stator core, into the cavities formed between the turns of the winding (18; 28) lying adjacent to each other, after which said conducting means is allowed to expand in such a way that the winding is thereby firmly clamped within the stator slots.

18. A method according to claim 17, **characterized** in that the expandable conducting means for transportation of a cooling and/or a heating medium, before being inserted in the slots of the stator core, is deformed into a profile principally corresponding to the geometric cross-section of said cavities.

19. A method according to claim 18, **characterized** in that said conducting means, before being inserted in the slots, is deformed in such a way that it corresponds to an essentially triangular profile.

20. A method according to claim 17, **characterized** in that the expandable conducting means for transportation of a cooling and/or a heating medium is inserted in the slots of the stator core in a vacuous condition.

21. A method according to claim 20, **characterized** in that said conducting means expands by means of a pressurised fluid being fed into the conducting means.

22. A method according to any one of claims 12 - 19, **characterized** in that the conducting means (22; 17; 27) expands as a result of simultaneously being subjected to overpressure and heating, and that it is cooled thereafter while maintaining overpressure whereby the conducting means maintains its expanded form.

23. A method according to claim 22, **characterized** in that the expansion takes place by means of a heat conducting pressurised fluid circulating within the conducting means (22; 17; 27).

24. A method according to any one of claims 21 or 23, **characterized** in that the pressurised fluid constitutes the cooling and/or heating medium which is used at a later stage for cooling and heating the stator respectively.

25. A method according to any one of claims 12 - 24, **characterized** in that the cooling and the heating medium constitutes the same medium.

26. A rotating electric machine for high voltage, comprising a rotor and a stator having a core and a winding arranged in slots in the stator core, which winding confines the electric field and is provided by means of an insulated electric conductor (30) comprising at least one current carrying conductor (31), comprising also a first layer (32) surrounding the current carrying conductor, a solid insulation layer (33) surrounding said first layer, and a second layer (34) surrounding the insulation layer, **characterized** in that it comprises a device for cooling the stator, when it is in operation, to a temperature T1, and for heating the stator, when out of operation. to a temperature T2.

27. A rotating machine according to claim 26, **characterized** in that the device comprises at least one cooling and heating system for the stator and a supervision system (1) comprising means (3) which measure the temperature of the stator both during operation and out of operation respectively, and means (2) which control the cooling and heating system so that said temperatures T1, which the stator cools down to during operation, and T2, which the stator heats up to when it is out of operation respectively, are obtained and maintained.

28. A rotating machine according to claim 26 or 27, **characterized** in that the temperature T2 which the stator is heated up to when it is out of operation, is essentially equal to the temperature T1 which the stator cools down to when it is in operation

29. A rotating machine according to claim 26 or 27, **characterized** in that the temperature T2, which the stator is heated up to when it is not in operation, is somewhat lower than the temperature T1, which the stator is cooled down to when it is in operation, whereby T2 is preferably in the range of 0 - 20° C lower than T1.

30. A rotating machine according to claim 26 or 27, **characterized** in that the temperature T2, which the stator is heated up to when it is out of operation, is somewhat lower than the temperature T1, which the stator is cooled down to when it is in operation, whereby T2 is preferably in the range of 0 - 10° C lower than T1.

31. A rotating machine according to any one of claims 27 - 30, **characterized** in that the supervision system (1) also comprises means for measuring the temperature of the stator before operating for the first time, means for controlling the cooling and heating system such that the stator, before operating for the first time, is heated up to a temperature T3, and means which control the machine such that the machine is only put into operattion when the temperature T3 has been reached.

32. A rotating machine according to claim 31, **characterized** in that the temperature T3 essentially corresponds to the expected operating temperature T0 of the stator.

33. A rotating machine according to claim 31, **characterized** in that the temperature T3 is somewhat lower than the expected operating temperature T0 of the stator, whereby T3 is preferably in the range of 0 - 20° C lower than T0.

34. A rotating machine according to claim 31, **characterized** in that the temperature T3 is somewhat lower than the expected operating temperature T0 of the stator, whereby T3 is preferably in the range of 0 - 10° C lower than T0.

35. A rotating machine according to any one of claims 26 - 34, **characterized** in that the winding (8; 18; 28) is designed in such a way that it is not secured in the stator slots (9; 19; 29) before the temperature T3 has been reached.

36. A rotating machine according to any one of claims 26 - 35, **characterized** in that it comprises at least one expandable conducting means (22) for transportation of a cooling and/or a heating medium, which conducting means is inserted in ducts (21) in the stator core which are adapted for this purpose, in addition to means for the expansion of said conducting means, whereby said conducting means, after having expanded, is pressed against the inside of the duct in order to obtain good contact and heat transfer.

37. A rotating machine according to claim 36, **characterized** in that the conducting means, before being inserted, is coated with a layer of fusible adhesive agent.

38. A rotating machine according to claim 37, **characterized** in that the fusible adhesive agent contains a filler having good thermal conductivity.

39. A rotating machine according to any one of claims 37 - 38, **characterized** in that said means for the expansion of the conducting means comprises means which simultaneously subject the conducting means to overpressure and heating, so that the conducting means bears on the walls of the duct and that said fusible adhesive agent melts and essentially fills all cavities between the conducting means and the walls of the duct, whereby the conducting means is secured against the walls of the duct.

40. A rotating machine according to any on of claims 36 - 39, **characterized** in that the conducting means, before being inserted in the duct, is deformed radially to correspond to a diameter smaller than the diameter of the duct.

41. A rotating machine according to any one of claims 26 - 40, **characterized** in that it comprises at least one expandable conducting means (17; 27) for transportation of a cooling and/or a heating medium, which conducting means is inserted in the slots (19; 29) of the stator core, into the cavities which are formed between the winding turns (18; 28) lying adjacent to each other, in addition to means for the expansion of said conducting means, whereby said conducting means after having expanded clamps the winding firmly within the stator slots.

42. A rotating machine according to claim 41, **characterized** in that the conducting means has a profile that principally corresponds to the geometrical cross-section of said cavities, preferably an essentially triangular profile.

43. A rotating machine according to claim 41, **characterized** in that the expandable conducting means for transportation of a cooling and/or a heating medium is inserted in the slots of the stator core in a vacuous condition.

44. A rotating machine according to claim 43, **characterized** in that said means for the expansion of the conducting means which is inserted in the slots of the stator core, comprises means for feeding a pressurised fluid into the conducting means.

45. A rotating machine according to any one of claims 36 - 42, **characterized** in that said means for the expansion of the conducting means (22; 17; 27)) comprises means for simultaneously subjecting the conducting means to overpressure and heating, and that the machine also comprises means for cooling the conducting means while retaining an overpressure, whereby the conducting means retains its expanded form.

46. A rotating machine according to claim 45, **characterized** in that it comprises means for circulation of a heat conducting pressurised fluid within the conducting means (22; 17; 27).

47. A rotating machine according to claim 46, **characterized** in that the pressurised fluid consists of the cooling and/or heating medium which is used at a later stage for cooling and heating the stator respectively.

48. A rotating machine according to any one of claims 36 - 47, **characterized** in that the cooling medium and the heating medium consist of the same heat conducting medium which is cooled and heated respectively.

Fig. 1

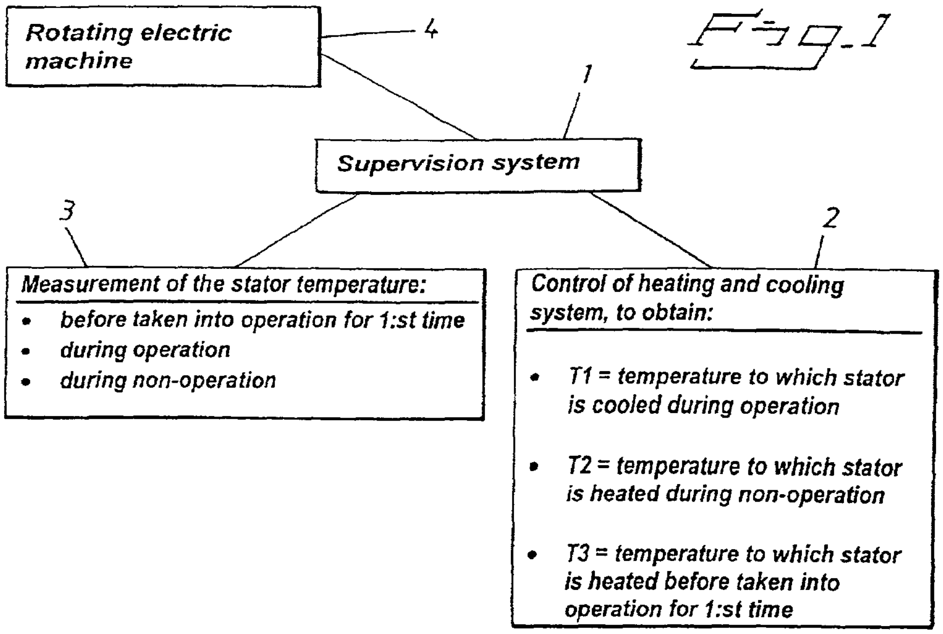


Fig. 2

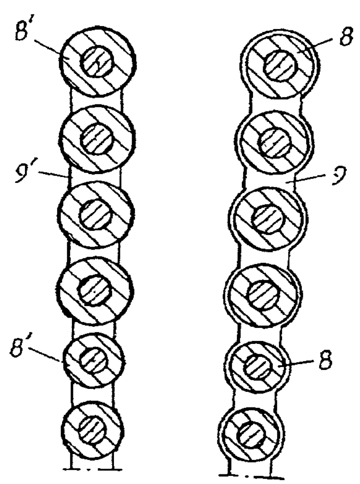


Fig. 3

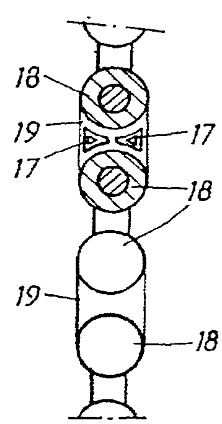


Fig. 4

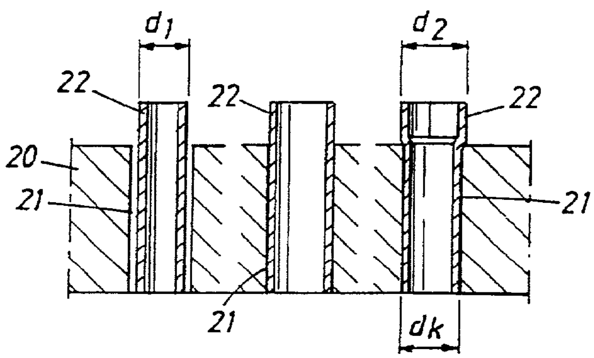


Fig. 5

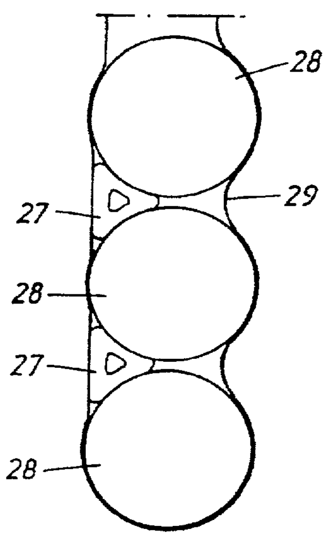
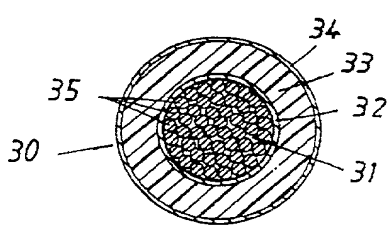


Fig. 6



Declaration, Power of Attorney and Petition

WE (I) the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

A Method For A Rotating Electric Machine And A Machine For Carrying Out The Method

the specification of which

☐ is attached hereto.

☒ was filed on November 26, 2001 as Application Serial No. 09/926,612 and amended on ______.

☒ was filed as PCT international application Number PCT/SE00/01069 on 25 May 2000, and was amended under PCT Article 19 on ______ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
9901929-1	SWEDEN	27 MAY 1999	☒ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

We (I) hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

(Application Number) (Filing Date)

(Application Number) (Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or under § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.	Filing Date	Status (pending, patented, abandoned)
PCT/SE00/01069	25 MAY 2000	

And we (I) hereby appoint the following registered practitioner(s):

22850

as our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to

22850

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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there are only 2 pages of drawings.

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